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CLIMATE CHANGE, GENDER, AND NUTRITION
Research Priorities for Zambia

Claudia Ringler, Alex de Pinto, Jowel Choufani, Sophie Theis, Mark Visocky, and Jeannie Harvey

Climate change is a substantial threat to sustainable development in Zambia, a country experiencing weather hazards, drought and dry spells, seasonal and flash floods, and extreme temperatures that may well increase under climate change. Achieving the goals of Feed the Future and the Global Food Security Strategy requires careful consideration of the impact of relevant climate science on agricultural production, while at the same time considering other cross-cutting issues that influence agriculture-led poverty alleviation, resilience, and nutrition—such as gender. This policy note summarizes assessments of these linkages for Zambia under the Gender, Climate Change, and Nutrition Integration Initiative (GCAN).

Changes in Climate

Recorded climate trends for the 1960–2003 period indicate that Zambia's mean yearly temperature has risen by 1.3°C, an average rate of 0.34°C per decade. At the same time, mean rainfall has fallen by an average of 1.9mm per month, or 2.3 percent per decade since 1960 (GOZ 2015). No comparable data are available for the Feed the Future zone of influence (ZOI). Varying by location and model, future trends based on results from four global circulation models suggest that average temperatures will increase, that total rainfall will potentially decrease, and that the number of heavy rainfall events might increase. National average mean daily changes in the maximum temperature of the warmest month—the standard indicator of potential heat stress for agriculture—are projected to range from 3.0 to 4.1°C nationally, and from 2.8 to 4.1°C in the ZOI. Mean rainfall changes are projected to range from –79mm to 109mm for Zambia as a whole, and from –93mm to 144mm for the ZOI. Rainfall changes, which differ by model used, are projected to vary across the country, even in terms of the direction of change (Figure 1). And while the magnitude of temperature change also differs by model and location, there is agreement that temperatures will rise.

Despite these uncertainties, aggregated simulation results for five climate models paint a relatively clear picture of how crop production will be affected. Yields of maize, cassava, groundnuts, and sorghum are projected to be negatively affected, whereas yields of soybeans, rice, and barley might benefit from the changing climate (Figure 2). The overall effect on millet is more uncertain.

Zambia's Take on Climate-Smart Agriculture

Climate Smart Agriculture (CSA) involves practices to increase productivity sustainably; enhance resilience through adaptation; reduce or remove greenhouse gas emissions through mitigation, where possible; and enhance the achievement of national food security and development goals. CSA is an umbrella term encompassing a multitude of location-specific solutions and approaches, and is recognized, albeit with limits, as a potential means of contributing to the achievement of the United Nations' Sustainable Development Goals. CSA is not prescriptive, but rather is an approach that addresses climatic risks at the intersection of productivity, resilience, and climate mitigation. Zambia has prioritized CSA among its selected strategies for reducing greenhouse gas emissions, while allowing the country to adapt to climate change and maintain food security, as described in Box 1 (GOZ 2015). In addition to the practices described in its nationally determined contribution document, other major

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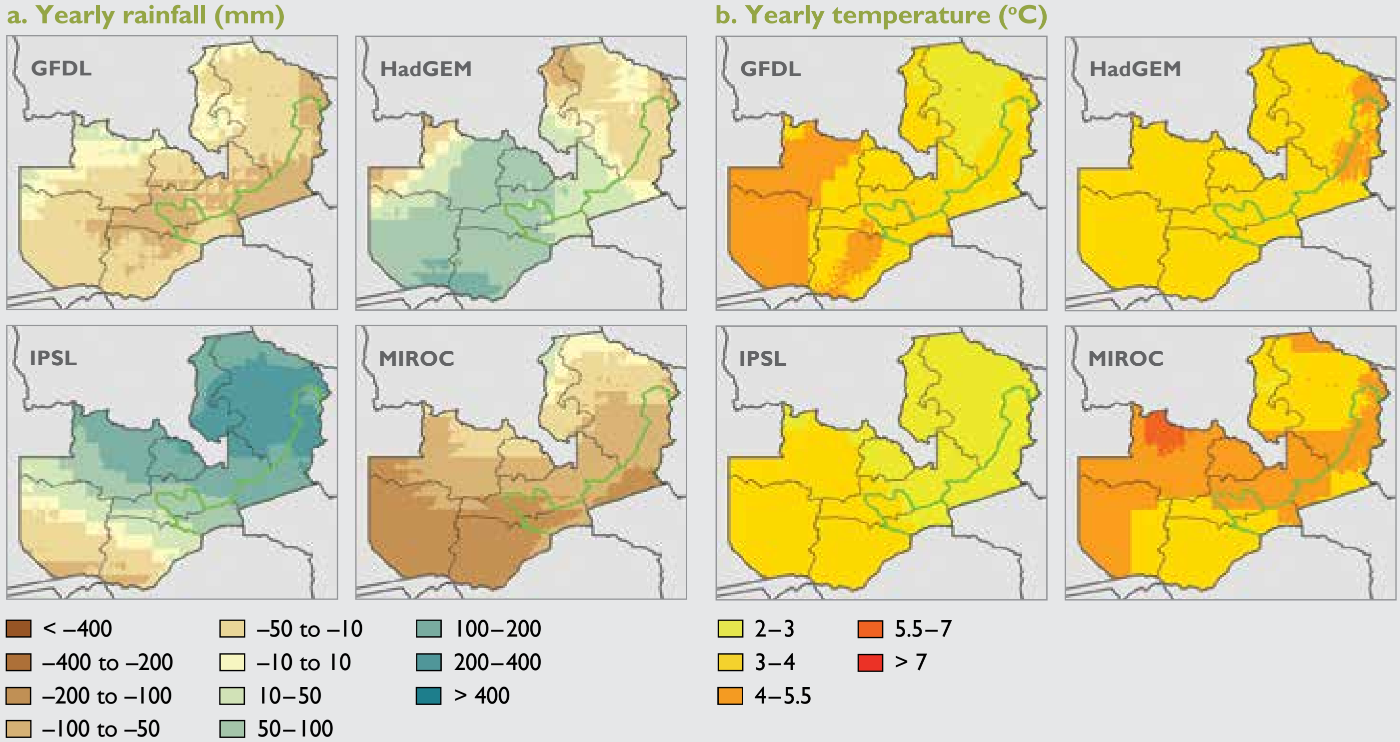
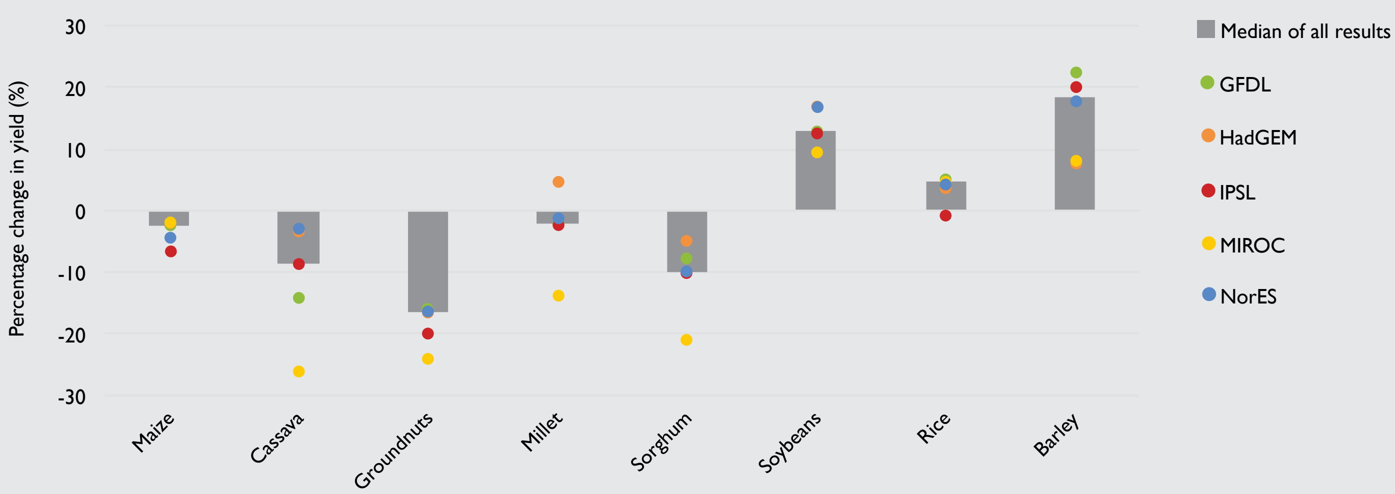
FIGURE 1. Predicted change in rainfall and temperature based on four climate models, 2000–2050



Source: Authors based on Müller and Robertson (2014).

Notes: GFDL = Geophysical Fluid Dynamics Laboratory; HadGEM = Hadley Centre Global Environmental Model; IPSL = L'Institut Pierre-Simon Laplace; MIROC = Model for Interdisciplinary Research on Climate. Simulations are based on Representative Concentration Pathway 8.5. The zone of influence is delineated by the green line.

FIGURE 2. Percentage change in yields due to climate change based on five climate models, 2000–2050



Source: Devised by authors based on Rosenzweig et al. (2014) using weights from MapSPAM harvested area (You et al. 2014).

Notes: GFDL = Geophysical Fluid Dynamics Laboratory; HadGEM = Hadley Centre Global Environmental Model; IPSL = L'Institut Pierre-Simon Laplace; MIROC = Model for Interdisciplinary Research on Climate; and NorES = Norwegian Earth System Model.

Box 1. Zambia's plans to address climate change through agriculture

The key activities on agriculture proposed in Zambia's (intended) nationally determined contribution document include the promotion of

1. climate-smart agricultural practices through conservation agriculture, agroforestry, the use of drought-tolerant varieties, water-use efficiency management, and fertilizer-use efficiency management;
2. the use of landraces of cassava, maize, sorghum, finger millet, beans, cowpeas, and their wild relatives;
3. climate-smart livestock practices through improved feed management, improved animal health, improved rangeland management, and use of drought-tolerant breeds; and
4. sustainable aquaculture practices through improved water management and feeding regimes, and the use of appropriate stocks.

climate-smart practices in use in Zambia include minimum soil disturbance, crop rotation, crop diversification, legume intercropping, and leaving crop residue in the field (Kaczan, Arslan, and Lipper 2013; Arslan et al. 2015). Such practices help address rising temperatures by spreading production risk. Nevertheless, the adoption of such practices by farmers has been low, despite heavy promotion by the Government of Zambia, including through subsidies (Haggblade and Tembo 2003). Key constraints include labor use and competition for crop residues with other uses (such as livestock feed, cooking fuel, and thatching material), as well as upfront investment costs (McCarthy, Lipper, and Branca 2011). Other technologies that have yet to be considered include low-cost precision agricultural technologies to guide water and fertilizer applications.

Different agroforestry systems, including agri-silviculture, alley cropping, improved tree fallow, and woodlots also have strong mitigation impacts, with sequestration rates of 5–15 metric tons of carbon per hectare (tC/ha) per year (FAO 2015). *Faidherbia albida* fixes nitrogen in its roots and leaves, and loses its leaves during the planting season, thus providing needed nitrogen to crops while allowing sufficient sunlight for crop growth. Field trials show that, when intercropped with maize, *Faidherbia albida* can double yields in settings where no additional fertilizer is used (Innovations for Poverty Action 2013). One of the reasons for the low adoption of agroforestry practices is lack of smallholder tenure security (USAID 2014; Richardson et al. 2015). The livestock sector also offers opportunities for reducing emissions and improving livelihoods. Improvements are feasible in forage digestibility, animal health and reproductive management, and carbon sequestration and manure management. Measures such as improving grassland management (for example, through sylvopastoral systems), improving feeding practices and forage quality, and enhancing manure management (for example, recycling and biodigestion) also have significant mitigation and productivity enhancement potential. Adoption constraints include lack of information; limited access to technologies; insufficient capital; and labor and time constraints, especially for women.

Gender, Youth, and Social Inclusion

In most settings, rural women and men, and boys and girls, are differentially affected by climate change and have different adaptive capacities based (1) on their livelihood activities—including the crops, livestock, and natural resources they rely on, the activities they perform along the value chain, and their domestic responsibilities; (2) their control over assets, which are needed for many adaptation strategies and are sometimes sold as a means of coping with shocks; and (3) the information available to them. Over a quarter of Zambian households are headed by adult women only. The Feed the Future baseline survey (Feed the Future 2013) found that 86 percent of such households were poor, a higher poverty rate than for households headed by adult men only (60 percent) or households headed by two adults (79 percent). Lack of male labor to adopt climate-smart practices, combined with high poverty rates make female-headed households especially vulnerable to climate shocks. Even in households headed by two adults, the costs and benefits of various agricultural practices are not uniformly distributed among all members. Projects promoting agricultural technologies and practices should consider how adoption affects different household members' assets, investments in human capital like education and health (for example, removing a child from school to help with agricultural work), control over income, decisions over production and sales, overall use of time, and energy expenditure. Men and women in the same household commonly cultivate both independent and family plots, with men mostly controlling income from joint plots and women controlling small revenues from crops they cultivate alone (if they are able to sell them). Women are primarily responsible for cultivating an estimated 10 percent of land held in households headed by two adults.

Women are less likely to have the resources needed to adopt CSA practices. Data on men and women from the Women's Empowerment in Agriculture Index (WEAI) collected in the Feed the Future ZOI indicate that excessive workloads and lack of access to credit are major contributors to women's disempowerment. Women also own and control fewer assets,

including land. All these factors may constrain the adoption of CSA practices that are labor-intensive or require long-term investments (see also Table 1).

Access to information is a critical prerequisite for comprehending climate change and adaptation options. A Feed the Future–commissioned gender and groundnut study found that men had greater access to information about conservation agriculture than did women. In the project's survey sample, half of female farmers versus two-thirds of male farmers reported receiving information or training on conservation agriculture (Curtis et al. 2015). Less access to information both reflects and may be influenced by the gender gap in literacy, given that 66 percent of women are literate compared with 83 percent of men (CSO–MOH–ICF International 2015). The channel and content of climate information needs to be tailored to meet the different needs of women, including their relative access to cell phones, radio, community groups, and other networks where information is disseminated.

Women typically exercise less decisionmaking power over income and agricultural production issues than do men. This can limit women's capacity to determine how they adapt to climate change, which can be at odds with the primary decisionmaker. Greater attention is also needed to identify whose assets are liquidated to deal with shocks, and whether girls' or boys' schooling is interrupted.

Providing services and investing in women's crops can increase women's access to income, but risks of backlash and appropriation of profitable crops by men need to be analyzed and mitigated. Gender-based violence can further limit women's bargaining power. In the gender and groundnut study, almost a quarter of women had experienced sexual violence in the previous year, usually from their intimate partner. Overall, half of the Zambian women and one-third of the Zambian men interviewed believed that domestic violence was justified under certain conditions. These high rates of acceptance of domestic violence create an atmosphere that discourages women's disagreement with the men in their households and communities, and likely constitutes a major limitation on women's adaptive capacity. Finally, high rates of early marriage in Zambia may be part of a coping strategy for families facing environmental and other stressors, given that 10 percent of girls are married before the age of 15, and 45 percent are married before the age of 18 (Mann, Quigley and Fischer 2015). Given the significant health, nutrition, and empowerment implications for girls who marry young, as well as for their children, further research is needed on the linkages among early marriage, climate change, and resource scarcity.

While Feed the Future programming cannot overcome gender inequalities overnight, efforts to strengthen women's assets, group membership, and access to credit and information can not only improve climate change responses, but also improve the status of women.

TABLE 1. Share of Zambian women and men in the zone of influence with inadequate attainment in WEAI indicators

Indicator	Women	Men
Input in productive decisions	8.9	2.9
Autonomy in production	17.9	10.8
Ownership of assets	15.4	2.7
Purchase, sale, or transfer of assets	25.5	5.6
Access to and decisions on credit	53.0	21.0
Control over use of income	4.9	1.4
Group membership	23.1	19.3
Speaking in public	25.0	4.7
Workload	51.9	24.1
Leisure	15.0	8.5

Source: Feed the Future (2013).
Note: WEAI = Women's Empowerment in Agriculture Index.

TABLE 2. Zambia's nutrition profile

Indicator	National prevalence	Prevalence in the zone of influence	Rank
Wasting in under five-years olds	6.3% (compared with 5.6% in 2008)	2.7%	80/130
Stunting in under five-year olds	40% (chronic malnutrition is the greatest burden)	45.5%	116/132
Overweight in under five-year olds	6.2%	4.4%	62/126
Anemia in women of reproductive age	29.2%	Not reported	124/185
Exclusive breast-feeding rate	72.5%	27.8%[a]	6/141
Adult overweight and obesity	29.2%	18.3%[b]	43/190
Adult obesity	8.9%	2.5%[b]	47/190
Adult diabetes	8.3%	Not reported	71/190

Source: Compiled by authors based on Feed the Future (2013) for ZOI prevalence, and IFPRI (2016) for national prevalence and rank.

a. The sample size is not statistically representative of the zone of influence.
b. These data are for 15–49 year-old women only.

Zambia's Nutrition Profile

Zambia's nutrition profile indicates severe nutritional deficiencies (Table 2). High rates of stunting in children under five-years old and anemia in women of reproductive age should be a priority for policies and interventions. Key micronutrient deficiencies include Vitamin A, which affects 54 percent of children, and iron deficiency anemia, which affects 58 percent of children, 36 percent of pregnant women, and 28 percent of nonpregnant women (Haggblade et al. 2016). Interventions should focus on the 1,000 day "window of opportunity" from pregnancy to a child's second birthday, emphasizing a combination of nutrition-specific and nutrition-sensitive approaches (USG 2016). Zambia's diet is mainly composed of cereals (predominantly maize); starchy roots; and, to a lesser extent, fruit and vegetables (FAO 2009). In urban areas, food consumption patterns are changing, with rice and sweet potatoes gaining importance. Fish is the most commonly consumed animal-source food, including by pregnant women, eaten by 41 percent of households compared with meat, which was eaten by 28 percent of interviewed households (Longley et al. 2014). Livestock products and fish form important dietary components among urban households, accounting for almost one-third of households' monthly expenditures on food (Hichaambwa 2012).

Households with higher incomes consume relatively well-balanced shares of animal-source foods, ranging from 27 percent for meats to 19 percent for dairy items. Poorer households predominantly consume fish (37 percent) and much smaller shares of meat, poultry, and dairy (24, 22, and 11 percent, respectively). Individual and household coping strategies in dealing with food insecurity include reducing total food consumption, skipping meals, selling and eating wild foods, selling livestock and assets, and cutting expenditures on health and education (Del Ninno, Dorosh, and Subbarao 2005). These coping mechanisms often have negative implications on nutritional status, and might be further exacerbated by climate change.

Suggested Research Priorities Moving Forward

Based on the literature review and discussions with USAID and partners, the following short- and longer-term activities are suggested to strengthen insights across the climate, gender, and nutrition nexus, and to advance evidence-based programming that integrates these themes in Zambia.

1. A review of aflatoxin research and projects, complemented by gendered focus groups to assess climate change, gender, and nutrition actions as aflatoxin challenges might well increase under future rainfall regimes
2. A review of available data and analyses on the role of markets to compensate for nutritional shortfalls under growing production variability as a result of climate change and on gendered constraints to market access
3. A review of evidence on youth in agriculture, drawing on existing datasets, possibly complemented with qualitative fieldwork to identify the conditions under which young men and women are more likely to remain in agriculture or to migrate, and examining the drivers of early marriage and implications on agricultural production and child and maternal nutrition
4. An analysis of women's access to information and their decisionmaking power about the main crops produced, and the implications on self-reported seasonal food inadequacy and household dietary diversity, using existing datasets
5. An in-depth investigation of the gender-specific economic barriers that prevent sustained adoption of CSA practices, including risk management
6. An analysis of the economic and nutrient-availability implications of shifts in farmers' land allocations as a result of the changing climate (for example, maize production areas shifting north)

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Claudia Ringler *(c.ringler@cgiar.org),* ***Alex De Pinto*** *(a.depinto@cgiar.org),* ***Jowel Choufani*** *(j.choufani@cgiar.org), and* ***Sophie Theis*** *(s.theis@cgiar.org) are employed in the Environment and Production Technology Division of the International Food Policy Research Institute, Washington, DC, USA.* ***Mark Visocky*** *(mvisocky@usaid.gov) is currently and* ***Jeannie Harvey*** *was formerly employed within the United States Agency for International Development's Bureau of Food Security.*

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